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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/525,359	11/03/2005	Johannes Konle	3926.136	3927
41288	7590	06/26/2008		
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EXAMINER				
FORREST, MICHAEL				
ART UNIT		PAPER NUMBER		
4162				
MAIL DATE		DELIVERY MODE		
06/26/2008		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/525,359

**Applicant(s)**

KONLE ET AL.

**Examiner**

MICHAEL FORREST

**Art Unit**

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 18-34 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 18-34 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/55/08)  
Paper No(s)/Mail Date \_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_

## **DETAILED ACTION**

### ***Claim Objections***

1. Claim 22 objected to because of the following informalities: the term “posses” appears to be a misspelling of the word “possess”. Appropriate correction is required.
2. Claim 28 objected to because of the following informalities: “foreseen” does not make sense in the context of the claim. It appears that the likely intention was that the alignment marks are “visible” on the layer elements. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:  

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
2. Claims 18, 19, 21, 22, 24, 25, 28, and 30-33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Regarding claim 18, the phrase “such as” renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d)
3. The term “basically” in claim 19 is a relative term which renders the claim indefinite. The term “basically” is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear how much of the layers comprise silicon or silicon compound alloy.

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4. The term "basically" in claim 24 is a relative term which renders the claim indefinite.

The term "basically" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear how much of the layer elements are comprised of electrically conducting material.

5. Claims 21 and 22 recite the limitation "the surface of the cavities" and "the surface of the inner cavities". There is insufficient antecedent basis for these limitations in the claims.

6. Claim 25 recites the limitation "the substrate" in line 3 of the claim. There is insufficient antecedent basis for this limitation in the claim. The claim also uses the term "basically".

7. Claim 28 recites the limitation "additional alignment marks" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim.

8. Claim 30 recites the limitation "the surfaces of the etched cavities" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim.

9. Claim 31 recites the limitation "the surfaces of the etched cavities" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim.

10. Claim 32 recites the limitation "the reactants" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim. The claim also uses the phrase "such as" which renders the claim indefinite.

11. Claim 33 recites the limitation "the reactants" in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim. The claim also uses the phrase "such as" which renders the claim indefinite.

***Claim Rejections - 35 USC § 102***

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claim 18, 19, 22, and 24 is rejected under 35 U.S.C. 102(b) as being anticipated by Lehmann(US Patent 5,262,021). Lehmann discloses a workpiece that comprises pores etched perpendicularly through a single substrate layer (see column 1, lines 37-41). Lehmann further teaches that the workpiece can be used as a catalyst support (see column 1, lines 9-13). Regarding Claim 19, Lehmann teaches that the layer comprises silicon (see column 1, lines 37-41). Regarding Claim 22, Lehmann teaches that the dimension of the pores can vary from 20  $\mu\text{m}$  to 50nm. (See column 2, lines 33-36) Regarding claim 24, Lehmann teaches that the silicon layer comprises n-doped silicon (see column 1, lines 37-44).

***Claim Rejections - 35 USC § 103***

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claims 18-24, 32-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lehmann(WO 99/061147) (*referred to herein as the US equivalent patent Lehmann*(US Patent 6,887,437) and further in view of Ashmead(US Patent 5,534,328). Lehmann teaches a reactor comprising a porous silicon substrate that is used as a catalyst support. The silicon substrate comprises a first and second main surface and holes extending perpendicularly and traversing from the first main surface to the second main surface (see Lehmann US Patent 6,887,437, column 1, lines 40-53). Lehmann does not teach a reactor where silicon substrate comprises layers. Ashmead teaches an apparatus for chemical processes that comprises a plurality of laminae with one or more channels on each lamina (see column 2, lines 58 to 64). The layers of laminae, as taught by Ashmead, allow macroscale production with microfluidic scale chemical kinetics, turbulent mixing, and compartmentalization. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the porous-silicon substrate as taught by Lehmann with multi-layer architecture to achieve macroscale production as taught by Ashmead as Ashmead teaches that the laminae provide for large-scale production.

16. Regarding Claim 19, Lehmann further teaches that the substrate comprises silicon as the substrate material (see column 1, lines 40-53). Ashmead further teaches that the lamina comprises silicon (see column 6, lines 31-36).

17. Regarding Claim 20, Lehmann further teaches a substrate comprising holes with the dimensions from 1 $\mu$ m to 10  $\mu$ m (see column 2, lines 1-2).

18. Regarding Claim 21-22, Lehmann further teaches that the inner surface features of the substrate can be coated with metal catalysts and with an intermediate inert layer comprising metal silicides (see column 2, lines 34-42). Ashmead also teaches that catalytic materials can be deposited into the surface of channels (see column 7, lines 53-56)
19. Regarding Claim 23, Ashmead further teaches that silicon wafers can have alignment indicia (see column 15, lines 30-34).
20. Regarding Claim 24, Lehmann further teaches that the substrate is n-doped silicon which is electrically conductive (see column 4, lines 42-45).
21. Regarding Claim 32, Lehmann further teaches that the reactor comprises an exterior housing with the porous silicon wafer disposed within the housing. The housing further comprises a first and second feed disposed on opposite sides of the wafer so that reactants can be fed into the reactor or withdrawn (see column 1, lines 49-53 and column 2, lines 17-29)
22. Regarding Claim 33, Ashmead further teaches that the apparatus can be replicated and can be joined in sequential and/or tandem operation depending on the desired operation parameters (see column 7, line 62 to column 8, line 4).
23. Claim 25-31, and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lehmann (WO 99/061147) (*referred to herein as the US equivalent patent Lehmann(US Patent 6,887,437)*) and further in view of Ashmead(US Patent 5,534,328). Lehmann teaches a

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method of fabrication of a highly perforated workpiece having holes extending perpendicular to a first surface of the workpiece, the method comprising the steps of etching a substrate silicon wafer to produce holes extending through the wafer. Lehmann does not teach the stacking of the equally processed wafers to produce an integral structure. Ashmead teaches the stacking of etched silicon wafers and the bonding of the wafers to produce an integral structure. Formation of an integral structure allows it to be used as chemical reactor capable of macroscale production of chemicals yet taking advantage of microscale chemical kinetics and compartmentalization. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the highly porous workpiece with stacking of the workpieces to produce an integral structure capable of macroscale production as taught by Ashmead.

24. Regarding Claim 26, Lehmann further teaches a method of fabrication where the etching is accomplished by deep anodic etching or photo anodic etching (see column 4, lines 42-54).

25. Regarding Claim 27, Ashmead further teaches that the fabrication of the lamina is accomplished by known semiconductor processing techniques for silicon wafers. Ashmead further teaches the fabrication of the lamina by anisotropic etching techniques. At the time the invention of the present application was made, plasma etching was a well known semiconductor processing technique known for etching highly anisotropic features. It would have been obvious to one of ordinary skill in semiconductor processing at the time of the invention to fabricate the porous silicon by plasma etching.



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26. Regarding Claim 28, Ashmead further teaches the addition of alignment indicia to the silicon wafers to ease the alignment of layers (see column 15, lines 30-34).

27. Regarding Claim 29, Lehmann further teaches a method of fabrication where the etched surface is pre-patterned by a photo-lithographic process (see column 5, lines 23-28).

28. Regarding Claims 31, Lehmann and Ashmead both teach that the holes or channels can be coated with a catalyst (see Lehmann column 2, lines 34-42 and Ashmead column 7, lines 53-56)

29. Claim 34 merely discloses an intended use of the catalytic reactor to reform feed fuels to a fuel cell.

### ***Conclusion***

30. Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL FORREST whose telephone number is (571)270-5833. The examiner can normally be reached on Monday - Thursday, 9:00am - 4:00pm.

31. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on (571)272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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32. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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